Johnes Disease Fact Sheet

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This fact sheet is designed to help you understand Johnes Disease (JD) by providing information on why you should be concerned about it, how does it get into your herd, what do Johnes infected cows look like, how long does it take them start looking sick, how is it transmitted from animal to animal within your herd, how much do cows shed and how long does it survive, how can it be controlled and testing for Johnes Disease.

Economic impacts of JD on dairy herds:

Production: The production loss for any dairy herd seems to be related to the JD prevalence and the average age or lactation for the herd. Research suggests that production losses begin when the average lactation for the herd is about 3 lactations and increases from this point as the average lactation age gets greater. Needless to say, herds with higher prevalence also have associated higher production loss. In herds with an average lactation age of more than 3 lactations, infected cows have been shown to produce up to 16% less than non-infected herdmates.

Early marketing (culling): Cows with JD have an associated decrease in reproductive efficiency that may lead to marketing earlier than normal

Veterinary cost: Many times there is an increased cost of treatment due to attempts to treat the diarrhea associated with JD. As there is no effective treatment, it is important to recognize JD early to reduce the amount of unnecessary treatment and risk of antibiotic residues in milk or meat.

Genetics – early marketing leads to loss of potential genetic increases that could have been realized from AI breedings.

California Johnes Disease Prevalence:

The approximate prevalence of JD in California is based on Elisa blood testing during the NAHMS dairy project in California and analyses completed by Dr. John

Adaska of the California Animal Health and Food Safety Laboratory. The analysis estimates that….

4% of dairy cows may be infected

66% of dairy herds may have at least one JD infected cow

42% of dairy herds may have 2 infected JD cows

We do have Johnes Disease in California dairies, however, due to management practices on most CA dairies (ie, primarily culling rates of 30-40% per year), few cows are often seen with classical clinical signs of JD. However, in CA areas where management practice result in lower yearly cull rate, more clinical JD cows are reportedly seen.

Introduction of JD into your herd:

Replacements:

Any cattle whether heifers at any age, adult cows or bulls can be a source on JD for your dairy herd. When efficient to do so (ie animals are old enough to be detected by blood or fecal testing…2nd lactation cows), tests any new animals that have entered the herd for JD before mixing with the general populations. Whenever possible, determine the JD status of the herd of origin for replacements before purchasing. Purchase only from low risk herds. Ask for proof of risk for JD.

The risk of introduction of JD into your herd by purchase of replacement animals is directly related to the prevalence of the herd of origin. There is a 70% risk of introduction of at least one JD replacement when 10 replacements are purchased from a JD infected herd. When 40 replacements are purchased from a JD infected herd, there is a 90% chance of getting at least 1 JD infected replacement. Purchasing replacement from the general population without knowledge of the JD status of the herd of origin has a risk of 65% when 40 replacements are purchased. This risk can be reduced to less than 10% when purchases are from a herd with known status due to testing.

Total, true "closed herd" concept is a wise strategy. If any animals (heifers, cows, bulls) enter your herd, it is not a closed herd.

Causes of the clinical signs:

MAP (Mycobacterium avium subspecies paratuberculosis) or Johnes Disease bacteria is eaten and enters down into the GI tract of the animals, usually a young calf.

The bacteria invade the lining of the GI tract; enter into lining cells as well as being engulfed by macrophages. Within these macrophages, the bacteria can survive and live in a protected location from the body immune system

Cow's immune system responds to the invading bacteria by send white blood cells and immune substances to the site of invasion.

The cow continues to respond to the JD bacteria and this immune response causes the GI tract wall to progressively thicken.

The thickened GI tract wall prevents the nutrients for the dairy ration from being absorbed into the blood stream where it could be disturbed for the body's needs.

Cow remains hungry and eating, however, the nutrient can't enter the body so the cow looses weight and the excessive GI tract materials turn to diarrhea. So the cow end up staving to death even though she is eating everything she can.

Clinical signs of Johnes Disease:

JD is a progressive, chronic disease of older cows (>2-3 lactation). As the clinical signs of JD become evident only after a prolonged incubation period following infection, the disease will progress slowly toward the death of the cow. However, it should be borne in mind that the disease will always be progressing toward poorer body condition and increased severity of diarrhea. No effective treatment is available to stop this disease.

Primary signs of JD:

Weight loss – progressive loss of body condition

Diarrhea – continued diarrhea, often beginning at calving or other stressful periods

Appetite – normal appetite, continue to eat

No response to therapy – currently there are no treatments that are beneficial for the treatment of JD, therefore, it is essential to diagnose JD cows early to prevent the loss from ineffective treatment attempts.

Secondary signs of JD:

Bottle jaw – this may appear similar to the fluid accumulation seen with severe, chronic parasitism

Few cows in any single dairy will show clinical signs of JD, however, there is 10 or more other JD-infected cows that are progressing toward the clinical form of the disease that have not begun to show the clinical signs..

It is an indication of a major flaw in the control program for JD when many cows have clinical signs at any one time on a dairy or when first lactation heifers show clinical signs of JD.

Incubation period (time from infection to appearance of clinical signs):

Ranges from 2-10 years – may vary with the initial infective dose; large doses may be associated with shorter time from infection to expression of clinical signs. The take-home point is that the infections that mostly occur in young calves will not become clinically evident until the cow is 3 or more years old.

Clinical signs to watch for in your herd:

These are signs that you might see when you are doing the veterinary reproductive checks or watching cows at the feed bunk. Watch for these signs and compare what you see in individual cows to the rest of the animals in the pen.

Manure – cows with constant, chronic diarrhea or loose manure

Body condition score – look for cows that are thinner than the other cows in the pen

Appetite – look for cows that are always at the bunk but loosing weight and having diarrhea

Stages of JD infection:

As the infections initially often take place in young calves and the clinical signs don't become evident until several years later, there is a progression of stages through which cows move on any dairy.

1 – infected; no shedding; no blood titer; no clinical signs

2 – infected; shedding; no blood titer; no clinical signs

3 – infected; shedding; blood titer; no clinical signs

4 – infected; shedding; blood titer; clinical signs

70% of infected cows can not be detected by culture or blood testing (Stages 1 and 2). The time when cows begin shedding at detectable amounts or when enough damage has been done to produce a detectable response in the blood is variable and unpredictable in any individual cow.

5% of infected cows may be heavy shedders of the JD bacteria in their manure.

Only 1% are clinically apparent in most herds at any one time. These cows can be anticipated to be shedding heavily in the manure and milk.

Methods of transmission of JD bacteria:

75% or more of the JD infections take place when newborn calves ingestion the JD bacteria shortly after birth in the calving pen area. Most infections take place before 6 months of age. This is the primary point of infection and JD contaminated manure is the main means of infection.

Ingestion of JD contaminated manure –

Calving pen – calves may become infected at the time they are born when the calving takes places in a manure filled calving pen with high concentrations of JD bacteria. Only a very small dose of JD bacteria is required to infect a day-old calf. This manure may come from the bedding or off the teats of the cow when the calf tries to suckle.

Flush alley – JD bacteria may be recycled from infected adult cows to the calves by the flush alley water from the lagoon. The JD bacteria may survive for extended periods of time in the lagoon and end up in the calf pens in the flush water. The flush water may contaminate the feet and legs of the calves or spread by aerosol onto the calf feed.

Refused feed – under certain conditions, feed from the adult cows that is not consumed is given to the young stock for feed. Traffic in the feed alleys primarily by trucks or push-up tractors may carry JD bacteria from the cross-alleys into the feed alleys and onto the feed. This JD contaminated feed has the potential to infected young calves under 3-4 months of age. As the calves get older beyond this point, they become more difficult to infect them by ingestion of JD contaminated manure.

Ingestion of colostrum with JD bacteria by newborn calves – Cows with clinical signs of JD shed more bacteria in their colostrum than non-clinical cases. Remember that colostrum from non-infected cows can become contaminated off the teats and udders when multiple cows calve in the same pen, when pens are not routinely cleaned between calvings or when the teats and udders are not cleaned before collecting the colostrum. Avoid feeding colostrum from known JD infected cows. In highly infected herds, colostrum replacers can be used instead of feeding potentially contaminated colostrums to control the spread of JD.

1000 bacteria/ml of colostrum or milk – enough JD bacteria to infected a calf when it is fed 1 quart soon after being born. Most of the time it is recommended to give at least 2 quarts soon after birth!

Ingestion of contaminated milk – both clinical and non-clinical cows shed JD bacteria in their milk. Clinical cows shed much more than the non-clinical, infected cows. Milk from the hospital pen cows should not be fed to the young calves. The exception to this is when the waste milk is effectively pasteurized prior to feeding to the calves. Effective pasteurization required heating to 65 C for at least 30 minutes. Routine monitoring is necessary to insure that pasteurization is continually effective.

Ingestion as adults – probably less than 5% of the total JD infections occur in adult cows. Infections have been found in older heifers that were fed refused feed from the JD-infected milking cow herd. The risk of infection is probably minimal for heifers that are breeding age or older. Even when older animals become infected, they are probably of little concern as they will not live long enough to become clinically apparent. They may however become shedders and thus contaminate the dairy environment.

Congenital or in utero infections - 10 to 20% of the total JD infections take place in the uterus during pregnancy or during the calving process. Clinically infected cows have a higher rate (20%) compared to the non-clinically infected cows (10%). Therefore this route is primarily a concern for clinically infected cows.

Amounts of JD bacteria shed by cows:

Manure –

Clinical cows – billions of JD bacteria are shed in each gram of manure. There is enough JD bacteria in a thimble full of manure from a JD cow to easily infect a young calf.

Non-clinical cows – millions of JD bacteria are shed in each gram of manure even though the cows are not apparent due to clinical signs

Milk –

Clinical cows – shed JD bacteria in their milk

Non-clinical cows – shed JD bacteria in their milk

Colostrum –

Clinical cows – the amount of JD bacteria shed in colostrum milk can be 1000 bacteria/ml or cc of colostrums. One quart of colostrums with this concentration of JD bacteria can infect a newborn calf. Remember that most dairies try to get two quarts of colostrums into their calves at birth and another two quarts by 24 hours of age.

Non-clinical cows – shed less than clinical cows but still probably enough to infect their calves.

Pooled colostrum containing colostrums from one infected JD cow can easily infect many calves.

Survival in the environment:

Water trough – 1.5 years
Lagoon – 9 months
Pasture - >1 year

Calf Management:

Using JD control practices in the calving pens can markedly reduce the spread of JD to calves. Here are some suggested practices to control JD:

One cow per pen whenever possible to avoid cross contamination of several calves from one JD infected cow.

Calving Pen – principle location for infection of calves

Clean – should be changed between each calving to prevent buildup of JD containing manure.

Dry – dry bedding will reduce the amount of teat and udder contamination and decrease the risk of the calf ingesting JD contaminated manure.

Manure – all manure should be removed from the calving pen between each calving. Manure is the primary vehicle for transfer of JD from adult cows to newborn calves.

Remove calves from pen ASAP to reduce the risk of ingestion of JD bacteria by the calf in the calving pens. This will lessen the opportunity for the calf to suckle on contaminated teats.

Culling to reduce exposure to JD in your herd:

Clinical apparent JD cows – all cows that exhibit clinical signs that are typical of JD (persistent diarrhea, weight loss, good appetite) should be immediately sent to market to reduce contamination of the dairy environment. For historical purposes, blood or culture testing should be completed to confirm JD in these animals.

Non-clinical, test positive cows – any cows identified by blood testing as being JD positive, should be confirmed as JD positive by fecal culture. Blood test positive cows should not be culled on the basis of blood testing alone. However as most blood test positive cows will be shedding the JD bacteria in their manure, appropriate management strategies should be applied to these cows to reduce the risk of new calf-hood infections. Their colostrum should not be fed to calves. The status of these cows should be prominently displayed in their health records and consider along with other health and reproduction data when considering culling.

How many cows should I test to get an idea of the JD status of my herd?

To get a beginning estimate of the JD status of your herd, 60 cows or more in their second lactation or greater should be tested by blood or culture. This can be done at any time in their lactation. Many veterinarians are recommending drawing blood as the cows go dry as the results will be available before they calve.

Testing for JD:

The two primary types of tests for JD: blood tests for JD antibody titers and culture of feces (manure) for the actual JD bacteria.

The blood ELISA test becomes positive when enough damage is done to the cow that she produces sufficient amount of JD-antibody to be picked up by the ELISA test. Similarly, the fecal culture becomes JD-positive when the cow shed enough JD bacteria in the feces to permit growth on the culture plates. The time at which cows become positive to either of these tests is specific to each cow and is variable.

If a cow has clinical signs of JD and the ELISA indicates the cow is positive, consider her infected. If you know the herd has a high prevalence of JD and the cow is ELISA positive, consider the cow infected. Negative test are difficult to interpret due to the variability as to when an infected may "sero-convert". The "S/P" ratio of the ELISA test maybe helpful in determining the status of a cow as cows with a ratio greater than 0.35 are positive.

In low JD-prevalence herds, it is reasonable to double check ELISA-positive cows with fecal culture.

Current ELISA cutoffs	Negative	<.20
	Suspect	>.21 to <.35
	Positive	>.35

Cows in less than their second lactation are not likely to be positive with either the Elisa blood or fecal culture test. For most herds, it is not economically justifiable to test their cows as the result of the testing will almost always yield negative results even though some of the animals may in fact be infected.

The results of the Elisa blood test can be available within a few days after submission of the samples to the laboratory. Culture testing of feces requires a maximum of 16 weeks for a negative result. In cows that are heavy shedders, the culture test may be give positive results in less than 16 weeks, however, it may still require more than 10 weeks as the JD bacteria is slowly growing.

<u>Possible links to Crohn's Disease:</u>

Clinical signs – the clinical signs of Crohn's Disease are those of chronic inflammatory bowel disease. The clinical signs are varied but often include chronic diarrhea, weight loss, abdominal pain, intestinal blockages with constipation, intestinal perferations and internal abscesses. No universally effective treatments have been found and most patients undergo repeated surgeries to remove affected segments of intestines.

MAP isolation in humans – The JD bacteria has been isolated from a few people felt to have Crohn's Disease. However, in the vast majority of Crohn's Disease patients neither the JD bacteria nor other bacteria have been isolated. A variety of causes have been suggested including allergy, autoimmune, other infectious agents. Most investigator agree that there is a component of excessive immune response.

Findings in pasteurized milk – The JD bacteria was found in finished pasteurized dairy products on the shelf in some European countries. This raised the concern that JD bacteria may be contaminating pasteurized milk products here in the US. Studies in the US using models that represent US pasteurization methods indicate that our current methods are able to kill the JD bacteria. Thus, at the present time, pasteurized dairy products are not felt to be a possible source of infections for humans.

Findings in marketed cows – Some studies looking at the lymph nodes of cattle at slaughter have found the JD bacteria in the nodes. The significance of these findings is not known at this time with respect to any hazard to human health.

JD risk assessment on your dairy:

Your herd veterinarian can do a risk assessment for JD on your dairy to give you an idea of how likely JD is to be introduced into your herd and spread among your cattle. To do this risk assessment, your veterinarian will go over the physical setup of your dairy and the management strategies that you are currently using for biosecurity. The AABP (American Association of Bovine Practitioners) has a JD risk assessment protocol that can be used on your dairy.

Some veterinarians have completed a certification program administered by the California Department Food and Agriculture to be able to do this risk assessment. Your risk assessment can be further reviewed by the CDFA Johnes Disease Epidemiologist. There is no cost for the CDFA review.

Educational materials on JD control:

The CDFA JD certified veterinarians can provide the educational materials developed by the California JD Advisory Committee. They should also be available to present this educational material for their dairy and beef clients.

Websites for more information:

Some frequently used website are:

www.aphis.usda.gov/ceah/cahm
www.crohns.org/
www.paratuberculosis.org
www.usaha.org/njwg
www.vetmed.wisc.edu/pbs/johnes
www.johns.org

For up to date information search the internet for Johne's Disease or Crohn's Disease. A recent search for JD found over 3000 locations and for CD, over 700,000 locations or sites.